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# An experimental detrending approach to attributing change of pan evaporation in comparison with the traditional partial differential method

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In predicting how droughts and hydrological cycles would change in a warming climate, change of atmospheric evaporative demand measured by pan evaporation ($E_{pan}$) is one crucial element to be understood. Over the last decade, the derived partial differential (PD) form of the PenPan equation is a prevailing attribution approach to attributing changes to $E_{pan}$ worldwide. However, the independency among climatic variables required by the PD approach cannot be met using long term observations. Here we designed a series of numerical experiments to attribute changes of $E_{pan}$ over China by detrending each climatic variable, i.e., an experimental detrending approach, to address the inter-correlation among climate variables, and made comparison with the traditional PD method. The results show that the detrending approach is superior not only to a complicate system with multi-variables and mixing algorithm like aerodynamic component ($E_{p,A}$) and $E_{pan}$, but also to a simple case like radiative component ($E_{p,R}$), when compared with traditional PD method. The major reason for this is the strong and significant inter-correlation of input meteorological forcing. Very similar and fine attributing results have been achieved based on detrending approach and PD method after eliminating the inter-correlation of input through a randomize approach. The contribution of *Rh* and $T_a$ in net radiation and thus $E_{p,R}$, which has been overlooked based on the PD method but successfully detected by detrending approach, provides some explanation to the comparing results. We adopted the control run from the detrending approach and applied it to made adjustment of PD method. Much improvement has been made and thus proven this adjustment an effective way in attributing changes to $E_{pan}$. Hence, the detrending approach and the adjusted PD method are well recommended in attributing changes in hydrological models to better understand and predict water and energy cycle.